CALIFORNIA DIVISION OF MINES AND GEOLOGY
FAULT EVALUATION REPORT FER-208

SIERRA NEVADA FAULT ZONE - HAIWEE SEGMENT
INYO COUNTY, CALIFORNIA

by
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INTRODUCTION

The Sierra Nevada fault zone is the complex zone of normal faults that forms the boundary between the Sierra Nevada and Basin and Range geologic provinces. Portions of the Sierra Nevada fault zone, and the right-lateral Owens Valley fault zone to the north have been evaluated by Bryant (1988, 1989). A short portion of the Sierra Nevada fault zone and the right-lateral Little Lake fault zone to the south have been evaluated by Wills (1988). Faults in the Haiwee-Rose Valley area (Figure 1) are related to these faults to the north and south. They are evaluated here for possible zoning under the Alquist-Priolo Special Studies Zones Act (Hart, 1985).

REVIEW OF PREVIOUS WORK

Although the Owens Valley fault zone was among the first-recognized earthquake faults in California (Whitney, 1872), faults in the Haiwee area to the south have been recognized only relatively recently. Neither the 1938 geologic map of California (Jenkins, 1938) nor the original Death Valley sheet of the Geologic Map of California (Jennings, 1958) show any traces of the Sierra Nevada fault zone in the Haiwee or Rose Valley areas. The second edition of the Death Valley sheet (Streitz and Stinson, 1974) was apparently the first to show the Sierra Nevada fault zone in this area.

Stinson (1977) and Duffield and Bacon (1981) have published more detailed maps of the area since that time. Both Stinson and Duffield and Bacon map north-trending faults in a broad zone across the alluvial fans at the base of the Sierra Nevada. Those faults which have been mapped as offsetting Quaternary units are shown on Figure 3.

Stinson (1977) mapped many north to northwest-trending faults in alluvium and bedrock along this zone. No symbols for fault displacement are shown on his map, nor is there an accompanying text, but his cross-sections show down-to-the-east offset on steeply dipping normal faults. Alluvial units offset include Stinson's Qf and Qal units. Stinson assigns a Holocene age to both of these units, which together form the entire alluvial slope of the Sierra Nevada. These units can be divided into younger and older Pleistocene alluvium based on field checking for this report as well as Holocene alluvium, as is discussed below.

Duffield and Bacon (1981) mapped the major strands of the Sierra Nevada fault zone in this area but did not map many of the strands mapped by Stinson (1977). Duffield and Bacon show these faults as generally east-facing scarps in older alluvium, younger alluvium and bedrock. Duffield and Bacon correlate older alluvium west of Rose Valley with alluvium that underlies a 400,000 year old basalt on the Little Lake quadrangle to the south (Duffield and Smith, 1978). Their younger alluvial unit is shown in their map legend as late Pleistocene to Holocene. It is this alluvial unit which can be sub-divided based on field checking for this report, as discussed below.

Neither the slip rate, nor the total offset on this segment of the Sierra Nevada fault zone is known. The high, straight, fault-line scarp of the Sierra Nevada suggests large total displacement, but the total amount and the timing of faulting are unknown.

INTERPRETATION OF AERIAL PHOTOGRAPHS AND FIELD CHECKING

Geomorphic evidence for recently active faults was interpreted on aerial photographs and plotted on 7.5-minute topographic maps (Figure 4). Air photos of 1:30,000 scale, taken by the U.S. Geological Survey in 1976, were used for the majority of the area. A small part of the area was covered by 1:12,000 scale photos by the University of Nevada-Reno. Several localities along the Sierra Nevada fault zone were field checked by this writer and E.W. Hart, W.A. Bryant and J.A. Treiman on 3/10/89.

The traces of the Sierra Nevada fault zone on the Haiwee Reservoirs, Haiwee Pass, Coso Junction, and Long Canyon quadrangles generally follow the mountain front (Figure 4). They tend to be on the alluvial fans less than a mile from the mountain front, rather than immediately at the base of the range. East-facing normal faults are most common, although back-facing scarps exist. Scarps tend to be low and erosionally degraded except near springs where spring sapping may have steepened the scarps. Lateral stream erosion also has steepened some scarps. Left-stepping en echelon scarps at locality 1 (Figure 4) may indicate a component of right-lateral offset. A right-laterally deflected drainage at locality 2 (Figure 4) also may indicate a right-lateral component.

Units offset by these faults include granitic bedrock and late Pleistocene alluvium. Alluvial units are mapped as Holocene fan deposits and alluvium by Stinson (1977) and as latest Quaternary "younger alluvium" by Duffield and Bacon (1981). Based on interpretation of aerial photos, it is possible to divide the fan deposits (Qf of Stinson, Qya of Duffield and Bacon) into older and younger Pleistocene alluvium as well as minor Holocene alluvium in stream channels. Older alluvium is isolated above modern stream channels and is also exposed in the side of the channel now occupied by the Haiwee Reservoirs. It therefore pre-dates the late Pleistocene overflow of Owens Lake which incised the channel.

Where observed in the field this older alluvium contains grantic boulders on the surface which are deeply pitted. Boulders buried in the soil are deeply weathered and decomposed to grus. The soil has also developed a reddish color (probably in the 7.5 YR range) and a well-developed B horizon. All of these factors indicate that this material is of late Pleistocene age; probably equivalent to Tahoe stage glacial deposits (60,000 to 100,000 years) or older.

Younger Pleistocene alluvium is deposited discontinuously over the older alluvium on the Haiwee Reservoirs and Haiwee Pass quadrangles but becomes more continuous to the south. In the field this material is a light brown silty sand with granitic cobbles and boulders. It is unconsolidated, and boulders on the surface have started to spall and develop pits. This unit is probably equivalent to Tioga stage glacial deposits of latest Pleistocene age.

At localities 3 and 4 (Figure 4) faults are expressed as low, degraded scarps in older alluvium. At locality 3 no scarps were observed in younger alluvium. At locality 4 the scarp appears to project through younger alluvium on air photos but on the ground no well defined scarp could be found.

SEISMICITY

Seismicity of the Haiwee Reservoirs - Rose Valley area is shown on Figure 2. Only well-located earthquakes (A and B quality) are shown. Epicenters for the period 1969 to 1985 are depicted based on data from the California Institute of Technology (1985).

Earthquake epicenters are broadly scattered over the area, with a concentration east of the Coso Junction quadrangle probably related to the Coso Mountains volcanic/geothermal area. A smaller cluster of epicenters, east of Haiwee Reservoirs may be related to faulting in Lower Cactus Flat or volcanism. No clusters of epicenters occur along faults of the Sierra Nevada fault zone in the Haiwee Reservoirs - Rose Valley areas.

CONCLUSIONS

Traces of the Sierra Nevada fault zone on the Haiwee Reservoirs, Haiwee Pass, Coso Junction and Long Canyon quadrangles offset late Pleistocene alluvium and do not appear to offset latest Pleistocene (Tioga equivalent) alluvium. Where observed in the field, scarps are highly degraded and irregular. The movement was apparently dominated by down-to-the-east normal offsets, although there is weak evidence for a right-lateral component. Traces of the Sierra Nevada fault zone on these quadrangles do not appear to have been active in Holocene time.

RECOMMENDATIONS

Traces of the Sierra Nevada fault zone on Figure 4 should not be zoned for special studies.

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Reviewed & approved.
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